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Treated Acquired Syphilis
on Life Expectancy**

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Untreated Syphilis in the Male Negro

II. Mortality During 12 Years of Observation

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This paper is the second of a series of studies of untreated acquired syphilis in the male Negro. It deals particularly with the effect of the disease on the life span of the human host. Subsequently in more detailed analyses of the material attempts will be made to describe and evaluate specific changes brought about by the disease in the infected individual, with particular reference to the cardiovascular system.

The material upon which the study is based consists of records of 410 Negro men with untreated syphilis and a comparable group of 201 uninfected Negro men. In a previous report (1) the population under study was described, considerable attention being given to the methods of diagnosis and to the physical and roentgenologic findings in the two groups, syphilitic and control. The individuals were carefully chosen, the decision as to the presence or absence of syphilis being based on history, physical examination, and serologic tests of the blood and spinal fluid. X-ray examinations of the heart were made on all the individuals selected for study, and additional roentgenologic studies were made when indicated. The syphilitic

group was chosen first, and the control group was selected in such a way as to have a nearly identical age distribution. All members of both groups were inhabitants of a rural area in Alabama.

The examinations were made and the study population selected during the winter seasons of 1931-32 and 1932-33, the time of year being chosen in order not to interfere with the usual agricultural occupations of the individuals involved. Since that time there has been an annual visit to the region by a physician for the purpose of obtaining specimens of blood for serologic examination, and a second complete examination was made of the majority of the group in 1938-39. In addition, a nurse in the local health department has kept in constant touch with the members of the group. Some of these have left the area from time to time, but most of them return eventually, and the whereabouts of practically every one is known through relatives and friends still living in the region. It is felt that as yet not one individual still living has been completely lost from observation.

An important part of the study has been the performance of autopsies on those who have died. Through the end of 1944, 129 were known to have died. Of these, 93 were examined post mortem. The majority not so examined lived in far outlying areas so that news of their death was not received promptly. In a few cases death occurred while the patient was living outside the area; however, news of the event was obtained from relatives. Since, as has already been pointed out, all the individuals not reported as dead are either still residing in the area or are heard of, at least occasionally,

A cooperative study project assisted by annual grants from the Millbank Memorial Fund. Initiated under the direction of Tallaferrero Clark, M. D. Clinical examinations by O. C. Wenger, M. D., R. A. Vonderlehr, M. D., J. R. Heller, Jr., M. D., and A. V. Deibert, M. D. Follow-up directed by M. Smith, M. D. Postmortem examinations by J. J. Peters, M. D. Pathologic examinations by R. D. Ellis, M. D. Statistical analysis by L. J. Usilton, M. A., P. T. Bruyere, M. D., M. P. H., and M. C. Bruyere.

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through relatives and friends, it is reasonably sure that there have been no other deaths than the 129 recorded.

From the foregoing remarks it can be seen that very little error can result from basing mortality rates on the assumption that the entire study group, syphilitic and control, has been under continuous observation from Jan. 1, 1933, to the present time. Because there is occasionally a time lag, however, between the occurrence of death and its report, and also because this analysis was commenced before the end of 1945, the study was limited to the events between Jan. 1, 1933, and Dec. 31, 1944, a period of 12 years. The original study group consisted of 410 syphilitics, of whom 101 died during the period mentioned, and 201 controls, of whom 28 died. It will be seen at once that there was a much greater mortality among the syphilitics than among the controls, 24.6 percent as compared with 13.9 percent.

As has already been stated, the control group was selected so as to conform to the syphilitic group with regard to sex

and age, so that these factors cannot account for any part of the difference. It is known that some of the control group have acquired syphilis, although the exact number cannot be accurately determined at present, and that about one-fourth of the syphilitic individuals received some treatment for their infection. Most of these, however, received no more than 1 or 2 arsenical injections; only 12 received as many as 10. The exact effect of these circumstances on the relative mortality of the 2 groups is not known. It is evident that infection with syphilis of members of the control group would tend, if anything, to make the mortality of this group more nearly like that of the syphilitic group. The effect of treatment on the mortality of the syphilitic group is open to question. However, the amount of treatment was small and certainly could not have accounted for any appreciable increase in mortality. Therefore, the fact that nearly twice as large a proportion of the syphilitic individuals as of the

Abridged life tables for Negro males aged 25-74 with untreated syphilis and not infected with syphilis, Macon County, Ala., 1933-44

Age period	Syphilitics					Controls				
	Observed population		Theoretical life table population			Observed population		Theoretical life table population		
	Person-years of observation	Number of deaths	Number surviving to beginning of age period out of 1,000 alive at age 25	Number dying in central year of age period per 1,000 alive at beginning of that year	Average number of years of life through age 74 remaining to an individual alive at beginning of age period	Person-years of observation	Number of deaths	Number surviving to beginning of age period out of 1,000 alive at age 25	Number dying in central year of age period per 1,000 alive at beginning of that year	Average number of years of life through age 74 remaining to an individual alive at beginning of period
			l_x	1000 q_x	e_x			l_x	1000 q_x	e_x
25-29.....	303.25	3	100,000	10.81	31.00			100,000	5.87	42.37
30-34.....	564.00	9	94,706	16.56	30.83	748.50	3	97,081	4.13	38.58
35-39.....	616.50	4	87,489	6.06	28.18			95,372	3.33	34.34
40-44.....	455.00	4	81,355	8.21	24.12			93,483	3.45	29.88
45-49.....	400.75	12	80,000	24.50	20.13	502.50	2	91,853	4.26	25.57
50-54.....	583.75	15	74,765	23.35	17.29			89,965	6.01	20.86
55-59.....	521.25	11	63,285	20.38	14.24	612.50	5	87,228	10.41	16.42
60-64.....	324.50	11	56,777	33.35	10.63			82,639	19.75	12.17
65-69.....	192.50	13	47,530	67.14	7.17	281.50	8	74,737	35.83	8.13
70-74.....	79.75	7	33,034	83.82	4.06			61,856	62.35	4.83

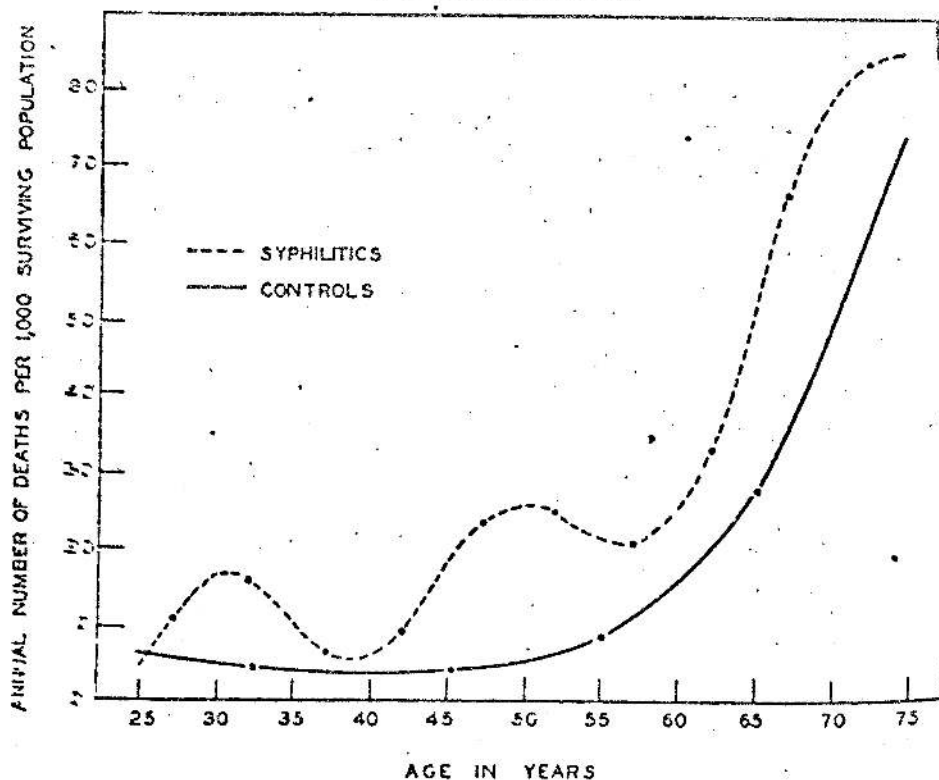
control group has died is a very striking one.

The foregoing observations led us, as a preliminary step in the analysis of the material, to attempt to measure more exactly the relative mortality of the 2 groups. The most efficient statistical procedure for that purpose, the construction of life tables, was adopted. The results are presented in the table and charts.

Since the period of the study was 12 years, from the beginning of 1933 to the end of 1944, each individual who survived into 1945 contributed 12 person-years of observation, at ages depending on his age on Jan. 1, 1933. Likewise, those who died contributed varying numbers of person-years of observation at various ages, depending on their ages in 1933 and the date of their deaths. The number of deaths at each age related to the number of person-years of observation at that age yielded a set of age-specific mortality

rates which could be determined separately for the syphilitic and the control groups. Because of the relatively small number of individuals, rates could not be computed for single years of age and groupings had to be made. Estimated rates for the individual ages were obtained by a process of interpolation, using third degree polynomials. These were then adjusted, where necessary, so that they would apply to persons exactly at a given birthday rather than halfway between two birthdays, as is the case with the usual age-specific mortality rates computed by relating the number of persons at a given age, say 25 years old (that is between their 25th and 26th birthdays), to the number of living persons of that age. The rates finally resulting from this process are indicated by the curves in chart 1 and those for every fifth year between 25 and 75 are listed in the column q_x in the table. In

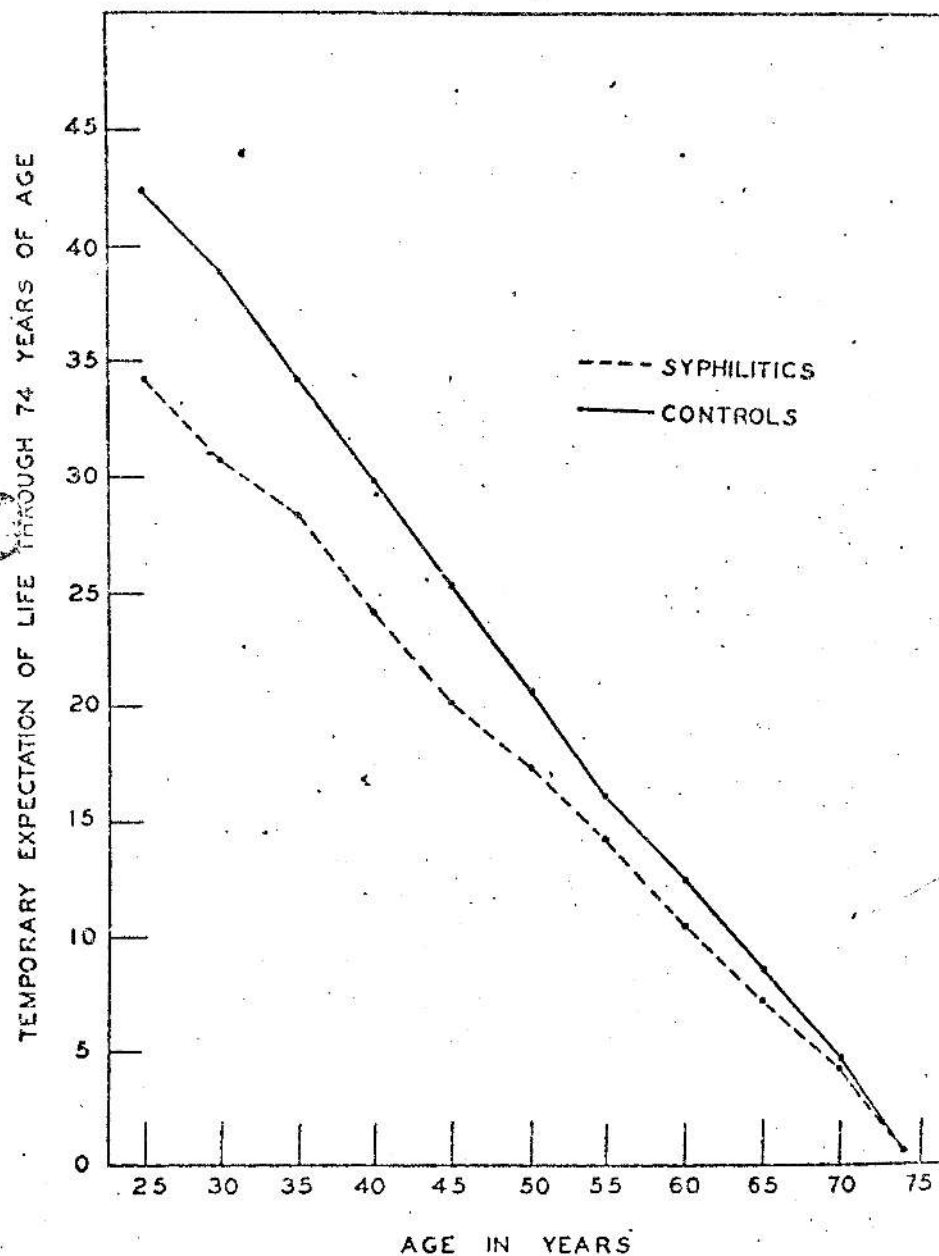
CHART 1.—Mortality rates among Negro men with untreated acquired syphilis and among nonsyphilitic control population.



the charts, the large dots indicate the basic points between which interpolation was made. The table and charts start with age 25 because at the time of the original selection all the men in the study

group were 25 or older. Data for ages 75 and up are not shown because the number of person-years of life and the number of deaths occurring beyond that age were so small that the rates were not reliable.

CHART 2.—Temporary expectation of life through age 74 among Negro men with untreated acquired syphilis and among nonsyphilitic control population.



There are several points of interest about the mortality rates obtained. The curve for the control group lies entirely below that for the syphilitic group. The control group curve is smooth, without peaks or irregularities, which is what one expects in a normal population. The curve for the syphilitic group has 2 marked peaks. The first occurs at about age 30. There is no obvious explanation for this, but it may be associated with the fact that the control group curve is also slightly higher at its beginning than later on. Possibly there is some factor operating on Negro men living in the region which accounts for both curves, or possibly both are merely the result of chance. The second peak in the curve for the syphilitic group reaches its highest point at about age 50. A similar peak, or at least accelerated upward trend, has been found by Usilton and Miner (2) who ascribed it to the fact that deaths from cardiovascular syphilis are most frequently observed at about this age.

The mortality rates for single years of life estimated from the observed data were applied successively to a hypothetical group of 100,000 persons aged 25. By this means was calculated the number of persons who would still be alive at each age from 25 to 74 if they had been subjected to these particular mortality rates. The results for every fifth year are shown in the columns headed 1_5 in the table. And finally the so-called "temporary expectation of life" through age 74 was calculated. This value, shown in the columns headed 2_5 in the tables and plotted in chart 2, is the average number of years of life under age 75 remaining to individuals reaching a given age.

From chart 2 and the corresponding data in the table it can be seen that the syphilitic individuals had a much shorter life expectancy than did the normal controls. At age 25 the normal individual averaged 8 more years of life than did the syphilitic of the same age. In other words, syphilis shortened the lives of its

hosts by almost 20 percent. A similar percentage reduction in life expectancy is found at ages up to about 45, after which the difference between the 2 groups decreases with increasing age.

The experience upon which the life tables are based is quite limited in comparison with the material used for the construction of most complete life tables for human populations. However, the differences between the syphilitic and control groups are so large that there can be no doubt of their significance. Furthermore, comparison with the recent standard life tables for the United States (3) reveals that the results are at least reasonable, in that the mortality rates for our control group are quite similar to those for all Negro men in the United States. The discrepancies which do exist are readily accounted for by regional differences and chance fluctuation in a group as small as ours, where a single death, more or less, causes a large difference in the results.

For these reasons we feel that our results are valid, and that the general levels of the mortality rates of the 2 groups, as reflected in the average expectation of life, are reliable. The location and size of the "humps" observed in the mortality curves are, of course, approximations since they are based on a somewhat small experience.

In conclusion, it can be said that the life expectancy of a Negro man between the ages of 25 and 50 who is infected with syphilis and receives no treatment for his infection is on the average reduced by about 20 percent.

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